Workshop #3
mid July mailing

#3

Life Science Division
Scarborough College
University of Toronto
1265 Military Trail
WEST HILL, Ontario M1C 1A4

Dear

At our Plant Development Workshop held at the University of Western Ontario in April, we agreed to have our next meeting in the fall at the Scarborough College campus of the University of Toronto. This meeting has been scheduled for Saturday, October 28th and will be held in the "civilized" atmosphere of the Humanities wing of the College.

It is hoped that a full day of presented papers and associated discussion can be organized. I would like at this time to invite faculty and graduate students to submit titles and abstracts to papers and/or titles to poster displays. Though there is little urgency in receiving abstracts at this early date, I would appreciate receiving tentative titles to papers and poster displays as soon as possible.

I am looking forward to hearing from you.

Sincerely yours,

R.E. Dengler,
Associate Professor,
Botany.

PLANT DEVELOPMENT WORKSHOP
Fall 1978

A one day workshop on plant development will be held on SATURDAY, OCTOBER 28th. The meeting will be held in the Humanities wing of the Scarborough College campus of the University of Toronto. See enclosed map.

Time 9:30 a.m. to 5:00 p.m.

Rooms Presented papers in room H-215

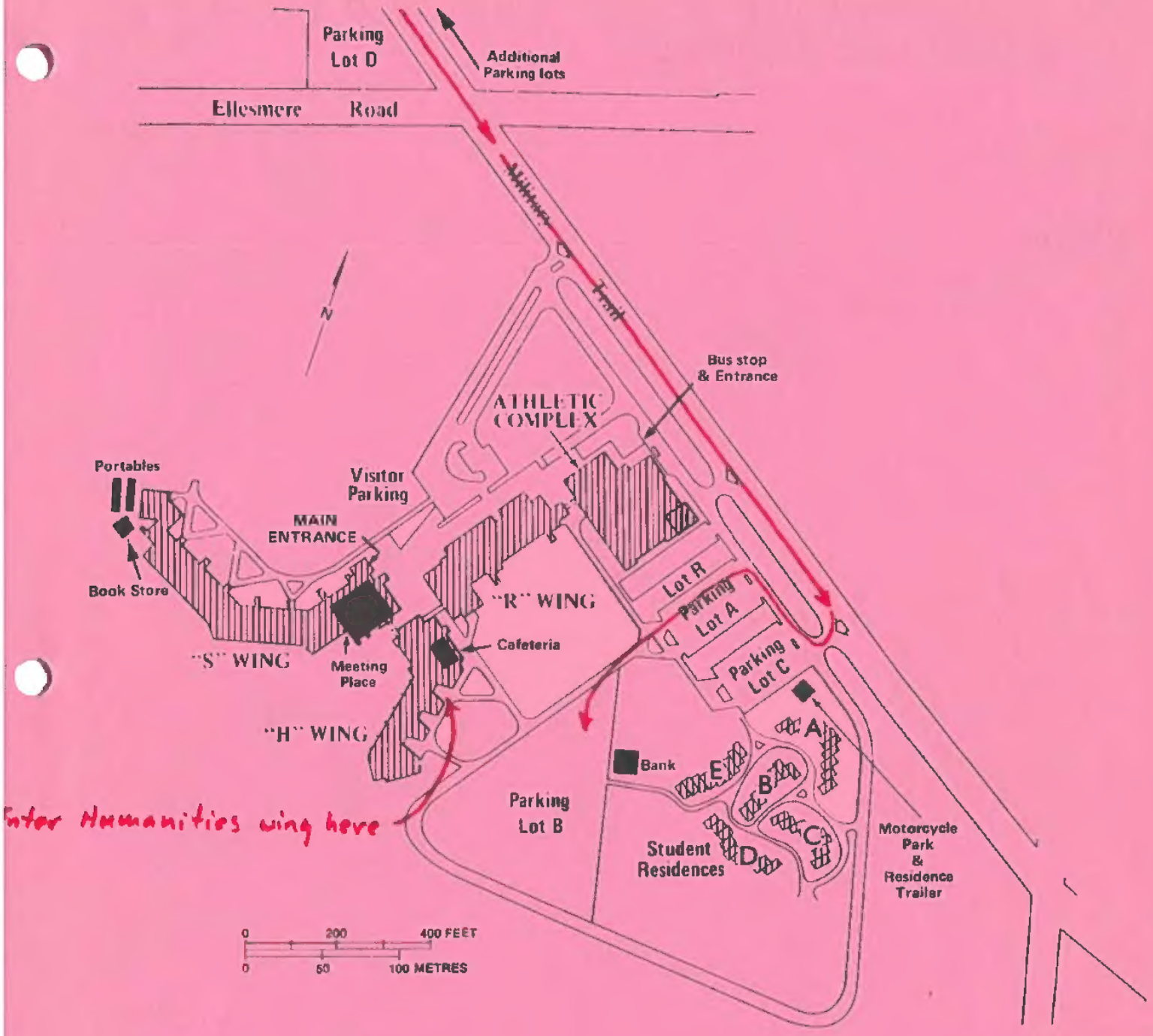
Poster displays, refreshments and lunch in the Faculty Lounge, room H-403B

Parking Lot B

Please submit titles of papers and poster displays as soon as possible - no later than September 15 - to:

Dr. R. Dengler
Life Science Division
Scarborough College
1265 Military Trail
WEST HILL, Ontario M1C 1A4 Phone 416-284-3218

Abstracts to presented papers would be appreciated by October 13th for duplication by the time of the meeting. It would be helpful if your abstracts are single spaced, typed on a half page or less, and include title, author(s) and institution. Presented papers will be assumed to be 15 minutes in length unless otherwise requested by the author(s).



"H"

H–403B	Faculty Lounge
H–409A	Social Sciences Divisional Office
H–527	Humanities Divisional Office

"R" WING

R–3042	S.C.S.C. Offices
R–3103	D.R. Campbell Lounge
R–3226	Graphics and Photography
R–4044	Physical Sciences Divisional Office
R–5223	Writing Lab

ATHLETIC COMPLEX

R–2255	Physical Education Office
R–3251	Pub

"S" WING

S–209	Post Office
S–223B	Foyer Francais
S–300	Lost and Found, Security
S–303C	Physical Services Office, Parking & Bus Tickets
S–303I	Residences Office
S–304	Health Service
S–338	Audio-Visual Department; TV studios
S–403	Council Chamber
S–407	Fee's Office
S–409	Principal's Office
S–413	Registrar's Office
S–414	Associate Dean (Academic)
S–418C	Student Services
S–421A	Life Sciences Divisional Office
S–624	Computer Centre

(3)

August 8, 1978

Dr. J. K. Morton, Editor
The Bulletin of the Canadian Botanical Association
Department of Biology
University of Waterloo
Waterloo, Ontario N2L 3G1

Dear Dr. Morton:

I would like to inform you and your readers of a forthcoming Plant Development workshop to be held on October 28th, 1978 at the Scarborough College campus of the University of Toronto, West Hill, Ontario. The meeting will run from 9:30 a.m. to 5:00 p.m. and will include a poster session and presented papers on a variety of plant development topics. For more information your readers should contact Dr. R. Dengler, Life Science Division, Scarborough College, University of Toronto, West Hill, Ontario M1C 1A4 (Phone 416-284-3218).

Enclosed is material which I have mailed to plant development biologists within reasonable driving distance; however, others may be interested in this event which is why I have brought it to your attention. This will be the third such semiannual meeting. We were pleased with the success of our previous two workshops and hope this one will be equally successful.

Thank you for your assistance.

Sincerely yours,

R. E. Dengler
Associate Professor of Botany

RED/kc

Encl.

THE CANADIAN BOTANICAL ASSOCIATION
Founded 1964

L'ASSOCIATION BOTANIQUE DU CANADA
Fondée en 1964

Department of Biology
University of Waterloo
Waterloo, Ontario
N2L 3G1

September 1, 1978

Dr. R.E. Dengler
Division of Life Sciences
Scarborough College
University of Toronto
West Hill, Ontario
M1C 1A4

Dear Dr. Dengler:

Thank you for your note on the Plant Development workshop. This will appear in the October CBA Bulletin but it is doubtful whether all of our readers will receive it before the next meeting.

Could you suggest to whoever organizes the next meeting that they let me have the notice a few weeks earlier? There was the same problem with the previous meeting -- I received the notice too late for publication.

Yours sincerely,

John K. Morton

J.K. Morton
Editor
CBA Bulletin

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PLANT DEVELOPMENT WORKSHOP #3

October 28, 1978

Coffee and doughnuts - 8:30 to 9:30 a.m. - Scarborough College Faculty Lounge, Room H-403B

Morning Session - 9:30 a.m. - Room H-214

1. Secretory tissues in Caltha palustris (marsh marigold) carpels.
   R.L. Peterson, M.G. Scott, and S. Miller - University of Guelph.

2. Involvement of microtubules and microfilaments in secondary wall orientation in radish root hairs.
   R. Seagull - York University.

3. French and Anglo-Saxon views on leaf development.
   R. Sattler and M. Dubuc-Lebreux - McGill University.

4. Evidence of heteroblastic leaf development in corn and other grasses.
   R. I. Greyson and D.B. Walden - University of Western Ontario.

5. Anther-ear 1 (an 1) - a tool for studying the control of flower development.
   A.J. Karpoff - University of Louisville.

6. The extraction and characterization of auxin from corn inflorescences.
   B. Schroeder - University of Western Ontario.

7. Stem elongation in corn - some preliminary observations.
   W.J. Smith - University of Western Ontario.

8. The physiognomy of tobacco plants and protoplast isolation.
   P.B. Hamilton and R.B. van Huystee - University of Western Ontario.

9. Elemental composition of globoid crystals in protein bodies from different regions of wheat grains.
   E. Spitzer and J.N.A. Loft - McMaster University.

10. Calcium distribution in globoid crystals of Cucurbita cotyledon protein bodies.
    J.N.A. Lott and E. Spitzer - McMaster University.

Lunch and Poster Session - 12:15 to 1:30 p.m. - Faculty Lounge
Room H-403B

Afternoon Session - 1:30 p.m. - Room H-214

11. Floral organography in the Amentiferae - problems and the role of organogenesis.
A. MacDonald - Lakehead University.

12. The mucigel on the surface of the root epidermis in corn.
J.K. Clarke - Carleton University.

13. An autoradiographic study of cell wall development in the corn root epidermis.
S.F. Kaine - Carleton University.

14. Apoplastic pathways in the root of Broad Bean (Vicia faba L.)
C. Peterson - University of Waterloo.

15. Root growth and cell proliferation in Vicia faba: temperature effects.
R.L. White - McMaster University.

16. The histology of the graft union in pea roots.
F.L. Stoddard - Carleton University.

17. Regeneration of vascular tissue and lateral root development in wounded pea roots.
M.E. McCully - Carleton University.

18. Differential behavior of sister nuclei in caffeine induced binucleate cells of Vicia faba.
S.W. Armstrong - McMaster University.

19. The generation of variation in nuclear volumes in root meristems.
D. Davidson - McMaster University.

Refreshments - 4:00 p.m. - Faculty Lounge, Room H-403B.

1. Turnbull, J. R. and Peterson, R. L. Department of Botany and Genetics, University of Guelph. Gross anatomy and ultrastructure of a Rosemarinic Acid over-producing cell culture line derived from Coleus blumei.

We have examined suspension cultures of a line of Coleus blumei that is noted for over-procuction of a phenol, Rosemarinic Acid (RA). Fresh material was examined with an epiflorescence microscope to determine the distribution of R.A. Material embedded in Spurr's resin was sectioned for light and transmission electron microxcopy. Preliminary data shows that the suspension cultures were made up of a variety of cell types. The R.A. was not uniformly distributed throughout the cell clumps.

The eventual goal of this project will be to determine the site of synthesis, and the location of deposition of Rosemarianic Acid in the cells of this line.

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2. Robert W. Seagull. Department of Biology, York University, Toronto. Arrangement of microtubules and microfilaments during oriented secondary wall formation.

In higher plants, cortical microtubules (mts) have been hypothesized to function as long track-like guide elements in the orientation of secondary wall cellulose microfibrils. The radish root hair system was chosen to test this hypothesis because: a)it has a well defined site of initiation of oriented secondary wall synthesis, b)it has been shown to have cortical microtubules paralleling the microfibrils of the secondary wall, c)hairs are long tubes protruding from the root thus offering easy access to large populations of identical cells.

Serial section analysis shows that in the region where secondary wall synthesis starts (20-60um from the hair tip), 60% of the mts are less than 1um long. At greater distances from the tip, where the secondary wall is well established, 35% of the mts are less than 1um long. Microtubules start and terminate randomly along the cell length, with no obvious zone of formation or synthetic centers.

Paralleling the mts, and often closely associated with them, are microfilaments (mfs), which may be arranged singly or in small bundles. Treatment with 1% DMSO during hair growth, or addition of 0.2% tannic acid during fixation, increases the number of observed mfs.

The significance of the mts distribution, as well as their apparent association with actin-like mfs will be discissed with respect to possible mechanisms of oriented wall microfibril deposition.

4. R. I. Greyson and D. B. Walden. Evidence of heteroblastic leaf development in corn and other grasses.

We previously demonstrated that an allometric plot of leaf length vs. leaf width from a single mature corn plant describes a distinctive curve. This curve illustrates a rather classic description of heteroblastic development along the stem. In an attempt to further characterize this classic illustration of leaf heteroblasty we have made a number of additional observations.

1) In general the detailed shape of the curve is consistent for a cultivar but may vary between cultivars.

2) Cob placement can routinely be noted near the inflection point of curve.

3) Grasses which do not bear an axillary inflorescent generate somewhat similarly shaped curves.

4) Heteroblasty is also evident in differences in cell types found on different leaves.

5. A. J. Karpoff, University of Louisville

Anther-ear (an-1) - a tool for studying the control of flower development in Zea mays L.

Anther-1 (an-1) when present in the homozygous recessive condition results in plants that are dwarfed in stature and produce ears containing perfect (monoclinous) flowers. The expression of this gene is apparently gibberellin related. an-1 plants were treated every four days with a serial (10^{-4}M - 10^{-7}M) range of GA_3 from the time of emergence of the first leaf through the coleoptile. Treatments were continued until harvest. Each plant received 100ul at each leaf. Response to the higher concentrations was evident within 48 hours. Reversal of the dwarfed growth habit was proportional to the concentration of hormone used. Other aspects of the plant also measured included time of emergence of tassels and silks, leaf number and size, stem height and internode lengths. Ears were dissected to provide some quantitative data concerning feminization of the cobs. The ability to supress the development of the stamens will provide a unique tool to study the mechanism of reversion both physiologically and morphologically. The timing of the developmental sequencing, if dose dependent, may provide valuable clues to controlling the development of male flowers in this species. A second unmapped gene termed "tassel ear" is also being studied as it has a similar ear morphology. Both genes appear to be plastic in their expression, in that the ratio of flower types in these lines contain various proportions of florets ranging from perfect to androgenious to sterile (no ovule, aborted stamens). These ratios may be modifiable by both environmental and hormonal manipulation.

6. B. Schroeder. The University of Western Ontario.
The extraction and characterization of auxin from corn inflorescences.

An accurate estimate of the amount of auxin present in plant tissues requires an efficient extraction technique as well as a sensitive assay method. A variety of extraction techniques ranging from simple methods yielding crude extracts to methods yielding very clean extracts have been reported in the literature. Not surprisingly, estimates of endogenous auxin content in corn tissues are extremely variable and difficult to relate to developmental events.

An extraction method has been developed which when combined with gas chromatography - mass spectrometry yields estimates of auxin content for nanogram quantities. The efficiency of the extraction procedure and an estimate of auxin content are assisted by the use of a small addition of ^{14}C IAA. We are attempting to establish the auxin levels in tassels and cobs from initiation through to flower maturity. The data derived from this detailed study should bear directly on the hypothesis for the hormonal control of flower development advanced by Heslop-Harrison.

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7. W. J. Smith. The University of Western Ontario.
Stem elongation in corn - some preliminary observations.

Internodal intercalary growth in Zea (corn) is an organized series of developmental events. As extension growth occurs, internodal units in a lag phase of development begin a period of rapid elongation which moves successively from lower to upper internodes. Two or three internodes maybe in this phase simultaneously. Patterns in corn internodal elongation differ between cultivars and with changing environmental conditions but remain variations of the same theme.

Two events maintain internodal elongation at the cellular level. Cells are produced mitotically in vertical files by a basal intercalary meristem, after which they elongate and are displaced towards the upper portion of the internode. During elongation an internode will have shorter cells at its base and longer cells near its upper limits. These conditions are illustrated clearly on the epidermis of the internode.

Regulation of this extension growth may be controlled by plant growth substances. In fact, this is the case in excised Avena internodes (Kaufman). Extension of excised Zea internodes can also be modified using exogenous Gibberellins and Auxins.

8. The Physiognomy of tobacco plants and protoplast isolation.

P. B. Hamilton and R. B. van Huystee, Department of Plant Sciences, University of Western Ontario, London, Ontario, N6A 5B7.

The various conditions of plant growth have been examined as they pertain to subsequent isolation of protoplast. The variables affecting successful isolation of protoplasts from leaves that were considered are: light, humidity including soil moisture, as well as the age and the height of the plant as influencing leaf conditions. A careful maintenance of optimal growth has given high return of protoplasts.

9.

SPITZER, Ernest and John N.A. LOTT
Department of Biology
McMaster University

Elemental Composition of Globoid Crystals in Protein Bodies from Different Regions of Wheat Grains

Energy dispersive x-ray analysis was used to study the elemental composition of globoid crystals in protein bodies from different regions of wheat grains. Regions studied included the aleurone layer, scutellum, coleoptile, young foliage leaves, stem, epiblast, radicle and coleorhiza. Distinct differences were found in types and levels of elements stored in globoid crystals of these areas. P, Mg and K were regularly found in globoid crystals, but levels of elements including Ca, Fe and Mn varied.

10.

LOTT, John N.A. and Ernest SPITZER
Department of Biology
McMaster University

Calcium Distribution in Globoid Crystals of Cucurbita Cotyledon Protein Bodies

Energy dispersive x-ray analysis was used to investigate the location of globoid crystals with relatively high calcium levels within cotyledons of Cucurbita maxima, Cucurbita mixta and Cucurbita andreana. The small globoid crystals in both upper and lower epidermal cells commonly contained calcium. Calcium was present in globoid crystals of all provascular regions with the exception of the very small provascular regions of C. maxima. In C. maxima and C. mixta cotyledons, some cases were observed where calcium was found in the globoid crystals of the first layer of mesophyll cells surrounding the provascular region, but in general calcium was absent from globoid crystals of palisade and spongy mesophyll cells. In C. andreana, globoid crystals of palisade and spongy mesophyll cells commonly contained at least some calcium. Cell position and cell type are factors affecting the calcium content of globoid crystals in protein bodies.

12. The mucigel on the surface of the root epidermis of corn. K.J. Clarke, Biology Department, Carleton University, Ottawa, Ontario.

The epidermal cells of young Zea mays roots are in an important position at the root-soil interface, and due to the characteristic surface of root tips of grasses it is possible to follow the developmental sequence of these epidermal cells. The most distal cell layer of the quiescent centre is separated from the root cap initials by a thin firm polysaccharide layer histochemically similar to the mucigel which coats the distinct columnar epidermal cells at the flanks of the meristem. The most apparent developmental change of the epidermis is cell shape. The epidermal cells are originally squamous and polygonal at the distal end of the quiescent centre and over the apical dome to the flanks of the root tip where they become densely cytoplasmic, actively meristematic and columnar with secretion of the polysaccharide forming the mucigel being at its maximum. Gradually the columnar cells elongate to become increasingly tabular, and vacuolated with the mucigel becoming progressively thinner. From the acropetal ends of these cells root hairs develop. Preliminary ultrastructural studies of the epidermis show the cytoplasm to be complex with considerable rough endoplasmic reticulum and many organelles possibly related to the mucigel secretion. Ultrastructurally the coating of the epidermis shows three distinct layers which can be correlated with their histochemical characteristics. To approach the question of the functions of the polysaccharide secretions of the root epidermis, studies on Zea mays grown under field conditions have been initiated recently.

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13. An Autoradiographic Study of Cell Wall Development in Corn Root Epidermis. S.F. Kaine, Department of Biology, Carleton University, K1S 5B6.

In corn, the mucilage of the root cap and the mucigel that lies over the columnar-shaped epidermal cells can be distinguished histochemically (Miki, M.Sc. Thesis, Carleton, 1977). Other workers have chemically characterised corn root cap mucilage but not the mucigel (Wright and Northcote; Biochem. J. 139: 525-534, 1974). It is possible with autoradiography to qualitatively determine the positions where macromolecules are laid down in corn root mucilages and cell walls. Preliminary autoradiographic studies with glucose-6-^{3}H and fucose-6-^{3}H show that the label from these two precursors is distributed differently between the root cap cells and the mucilage. In contrast both precursors label epidermal cells and mucilage similarly. Autoradiographs suggest that the mucigel is secreted by these columnar cells. As these cells become tabular the mucigel thins and the incorporated label is reduced so that in the region of root hair initiation there is little or no overall label in the outer periclinal walls. However, at the position where root hairs will develop, there is a high accumulation of label. This labelling persists at the tips of growing root hairs.

Autoradiographs of tissue labelled with either the tritiated glucose or fucose show that new radial walls in the epidermis frequently do not develop from a centrifugally expanding cell plate but rather grow centripetally from one or the other periclinal wall.

14. APOPLASTIC PATHWAYS IN THE ROOT OF BROAD BEAN (VICIA FABA L.)

Carol A. Peterson, G.B. Humphreys and P.H. Kroes, Biology Department, University of Waterloo.

The Casparian band in roots is discontinuous at the root tip where the endodermis is not yet mature and also in the region of secondary root growth before the endodermis of the secondary root matures and is functionally connected to the endodermis of the primary root. The mobile fluorescent dye PTS (trisodium 3-hydroxy-5,8,10-pyrenetrisulfonate) was used as a tracer to detect possible apoplastic pathways into the stele of the broad bean root. The roots of intact plants were immersed in 0.02% PTS in 1/4 strength Knops' solution for 24 hr, rinsed briefly, blotted and sectioned with a dry razor blade. The top surface of the section was immediately observed under ultraviolet light using a dissecting microscope placed into a specially constructed black box. The results showed that the root tip does not provide a pathway for PTS movement into the functional xylem of the stele. The dye usually did not penetrate into the central region of the root further than 0.56 mm from the root tip. The first discernable deposition of a Casparian band occurred 1.24 mm from the root tip. Thus, the apoplastic pathway is blocked in a much younger region than was previously supposed. However, an apoplastic pathway for PTS entry into the stele of the primary root was observed in the region of secondary root formation. The dye penetrated into the primary root as far as the endodermis and then into the stele along the flanks of the developing secondary root but the dye did not enter the cortex or the stele of the secondary root itself. This pathway has been observed when the secondary roots varied from 0.32 mm to 1.82 mm in length.

15. R.L.White. Dept. of Biology. McMaster Univ., Hamilton. Root Growth and Cell Proliferation in V.faba: Temperature Effects.

The onset of cell prol feration and root growth have been studied in primary roots of V.faba at 6, 15, 20, 25 and 30°C. Root growth followed a similar pattern at all 5 temperatures: 1) there was an initial period with no growth; this varied from 216 h at 6°C to 40 h at 30°C. 2) a period of continuous growth. 3) growth ceases. Mean root length when growth stopped was about 7.5 cm at 15 to 25°C and was significantly shorter at 6°C and 30°C. Mitotic activity began concomitantly with the initiation of root growth and reached a peak value when roots were ~0.8 cm long; though the initial peak in mitotic index occurs at different times at different temperatures, it coincides with a root length of ~0.8. cm. The peak mean M.I. ranged from 9.3 at 6°C to 20.3 at 15°C. M.I. decreased after the initial peak; the pattern of change differeed at the different temperatures. Nuclei were pleiomorphic in shape prior to the onset of root growth and mitosis. Nuclear volumes were determined and were found to increase during the first cell cycle in the germinating seed and to decrease in later cycles. The pattern of decrease varied, depending on the temperature. The results will be discussed in terms of: 1) differences in the degree to which cell proliferation and growth are integrated at different temperatures; 2) the non-steady state condition of the young primary root meristem and 3) lack of evidence that there is a critical nuclear volume associated with entry into mitosis.

16. Histology of development of graft union in pea roots. Frederick L. Stoddard, Department of Biology, University of Ottawa, Ottawa, Ontario.

When development of the union of pea roots splice grafted when 8 days old is followed with optical microscopy, the following sequence of events is observed.

Day 1. First mitotic figures appear above the graft (toward the shoot tip). Day 2. First mitotic figures appear below the graft (toward the root tip). Cells of pith, pericycle and cambium, above and below, show increased cytoplasmic content. Day 3. Cortical cells above the graft form nodules by repeated divisions and become more cytoplasmic. External swelling is first visible above the graft. Day 4. Nodulation and swelling appear below the graft as above at day 3. First new xylem and phloem differentiate on both sides. Callus derived from above-graft pith, pericycle and cambium swells into graft gap. Day 6. Above-graft nodules swell into graft gap. Dead cell material ("wound gum") at the original cut surfaces has thinned and been disrupted by growth of cells around it and has largely lost its previous autofluorescence and positive phenolic reaction. Day 7. Newly formed xylem bridges the now-coherent graft. Day 8. Phloem bridges the graft; growth is resumed. Day 12. A cambium which has divided several times bridges the graft.

This developmental sequence resembles but is faster than that described for most stem grafts.

17. Regeneration of vascular tissue and lateral root development in wounded pea roots

M.E. McCully, Department of Biology, Carleton University, OTTAWA. K1S 5B6

Severance of the stele of young main roots of pea results in formation of a bridge of vascular tissue in the remaining cortex. Differentiation begins close to the cut ends of the vascular strands on both the proximal and distal sides of the wound and progresses from both sides into the remaining piece of cortex and also back along the original strands. However, most of the vascular tissue which forms the bridge differentiates in the acropetal direction. Vascular regeneration is not affected by removal of the epicotyl or the root tip; it is greatly reduced but not prevented by removal of the cotyledons. Lateral roots which develop proximally to the wound emerge in a basipetal sequence. After the cut stele is bridged by new vascular tissue lateral roots also develop distally to the wound but in an acropetal sequence unless the root tip was removed, in which case the sequence is basipetal.

18. S.W.Armstrong. Dept. of Biology, McMaster Univ., Hamilton. Differential Behaviour of Sister Nuclei in Caffeine Induced Binucleate Cells of V.faba.

Studies of sister nuclei in binucleate cells are useful in analysis of nucleo-cytoplasmic and nuclear-nuclear interactions since the sister nuclei: 1) are formed at the same time; 2) share a common cytoplasm; 3) are genetically identical. Following caffeine treatment nuclei undergo a decrease in their volume. In binucleate cells, the degree of contraction is unequal in sister nuclei: i.e. they behave differentially. As part of a further analysis of the behaviour of sister nuclei we have determined: 1) the uptake of ^{3}H-labelled RNA into the post-mitotic nuclei of binucleate cells; 2) the rate of RNA synthesis in sister nuclei. Both studies confirm that sister nuclei behave differentially. We find that: 1) uptake of preformed RNA occurs at significantly different levels in sister nuclei; 2) the amounts of RNA synthesized by sister nuclei, indicated by grain counts, differ in sisters. The results provide further evidence that nuclear behaviour is determined, at least in part, by factors that are present in nuclei and that are not distributed equally between the two sister nuclei produced by a mitotic division. The differential behaviour of sister nuclei within a common cytoplasm reflected by differences in RNA uptake or synthesis parallel differences in nuclear volumes. They confirm that mitosis is, in some way, asymmetrical since it generates two nuclei capable of differential behaviour.

19. D.Davidson. Dept. of Biolgy, McMaster Univ., Hamilton. The Generation of Variation in Nuclear Volumes in Root Meristems.

Nuclear volumes span a wide range of values in many root meristems: a 5 to 8-fold spread of values is common. Volume differences between sister nuclei have been reported for pairs of nuclei in sister cells and in binucleate cells. In binucleate cells we have found that the mean ratio of volumes of sister nuclei is 1.17: to 1.26:1. In nuclei in sister cells the mean ratio was 1.21:1. Can volume differences of this magnitude generate the observed variability in nuclear volumes in meristems? In Z.may the mean spread in nuclear volumes was 2.03 ± 0.32-fold in columns of 5-14 cells and 3.1 ± 0.77-fold in columns of 5-19 cells. In V.faba the mean spread was 1.98 ± 0.61-fold in columns of 6-10 cells and 3.67 ± 1.15-fold in columns of 17-28 cells. It is clear that: 1) a lineage of cells that could be derived from a single initial cell by ~3 mitoses has about a 2-fold spread of nuclear volumes; 2) once ~4 divisions have been completed there is always about a 3-fold spread of values. The differences between volumes of sister nuclei parallel data reported for wheat roots that cytoplasmic division at mitosis is unequal. The joint contribution of nuclear and cytoplasmic inequalities arising at mitosis are sufficient to generate the observed variation in nuclear and cell size in root meristems.

POSTERS

Ultrastructure and Histochemistry of *Pellaea* Epidermal Cells Exposed to Low and High Humidity Conditions

R.L. Peterson, S.J. Rigby, and M.G. Scott
Department of Botany and Genetics, Univ. of Guelph

Paradermal sections through pinnae of the fern, *Pellaea glabella*, var. occidentalis revealed that anatomical and morphological changes could be induced in epidermal cells in response to environmental changes. Using a variety of techniques (LM, TEM, SEM, histochemistry), it was found that plants grown in a confined environment (high humidity and temperature, minimal air circulation) possessed epidermal cells with thin walls, thin middle lamellae and small tannin deposits in the vacuoles. Dictyosomes in the process of secreting vesicles and tubular cisternae of endoplasmic reticulum were frequent constituents of the cytoplasm. Pores in the stomata of these epidermal cells were generally wide open. In addition, guard cell cytoplasm was characterized by well-developed amyloplasts, degenerating plastids containing lipid-like bodies and amorphous, electron-dense deposits in cytoplasmic vacuoles. By contrast, specimens grown in an exposed evnironment (low humidity, cooler temperatures, circulated air) developed epidermal cells with extremely thick primary cell walls. Using the pseudo-Schiff's reagent for fluorescence microscopy and various histochemical dyes on fresh tissue (lignin pink, phloroglucinol and ruthenium red), it was shown that the cell wall matrix contained a high percentage of pectic and polysaccharide compounds. Walls were not lignified. Epidermal cell walls were convoluted in morphology and were frequently lined with a lipid substance. Large aggregates of ferric chloride-positive substances were present both in large central vacuoles and in smaller vacuoles dispersed throughout the peripheral cytoplasm. Guard cells contained copious amounts of a lipidic substance and chloroplasts with well-developed grana and prominent starch grains.

Secretory tissues in *Caltha palustris* L. carpels

R.L. Peterson, M.G. Scott, and S. Miller

Department of Botany and Genetics
University of Guelph

Caltha palustris L. carpels obtained from closed flower buds, flowers that had just reached anthesis, and from older flowers were examined by correlated light and electron microscopy. Three types of secretory cells are identified: trichomes located on either side of the cleft towards the base of each carpel, cells along the margins of the carpel cleft, and transfer cells along the locule lining immediately beneath the micropyle of the anatropous ovule. Numerous smooth endoplasmic reticulum cisternae and dictyosomes, the presence of secreted material between the cell wall and cuticle, and the proximity in the carpel wall of a region of phloem without associated xylem suggests that the trichomes are nectary trichomes. Droplets of secreted material were apparent in the region of trichomes. The cells lining the cleft and the transfer cells which have wall ingrowths along the tangential wall facing the locule also have cytological features of secretory cells. It is suggested that these cells are involved in the secretion of nutritive and/or chemotropic substances for pollen tube growth.

A. J. Karpoff. University of Louisville. Hormones and in vitro development of epiphyllous buds in Bryophyllum calycinum.

Uniform leaf segments, each containing a single marginal notch were explanted onto sterile media. These media contained the minerals of Murashige and Skoog, vitamins, iron, 2% sucrose and 1% agar. Hormones used included indole acetic acid, gibberellic acid, benzyl adenine and 2,4-D. Explants were grown for one week when the length of the longest leaf was measured. Also recorded were the number of roots and the average length of the two longest roots of each explant was calculated. High concentrations of 2,4-D (10^{-3}M-10^{-4}M) induced callus or callus and multiple root primordia at the notches. Callus never formed at any of the cut surfaces. BAP at concentrations of 10^{-5}-10^{-7}M provided the best growth stimulation. IAA, GA, 2,4-D generally suppressed growth of the leaves when compared to the control. With some exception average root length and number of roots followed the same rankings as for leaf growth. Color photographs and SEM photographs will illustrate many of the above.

P. C. Cheng, R. I. Greyson and D. B. Walden. Comparison of the development of male sterility in the three mutants ms 2, ms 9 and ms 10 of maize.

As part of a broader study the development of the male flower of corn we have prepared some LM and TEM observations of three male steriles ms 2, ms 9 and ms 10. Each of these non-allelic recessive characters, though superficially similar, behave differently at the cytological level. ms 9 exhibits abnormal development of PMCs and tapetum during the Pre-Callose Stage. On the basis of LM observation ms 2 first exhibits tapetal abnormalities during the Quartet Stage. ms 10 on the other hand shows no developmental failure until the Young Microspore Stage. Besides having different times of expression these cytological failures are each structurally distinctive of different organelles.

Some French References on Leaf Development

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October 30, 1978.

Dr. L. Peterson,
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University of Guelph,
Guelph, Ontario.

Dear Larry:

Your suggestion that we should try to organize a session on development for the CBS meeting didn't seem too good to me when you made it and I think I was rather negative to it. However, on reflection I realize that it was, perhaps, not the right way to look at it. My reason for being negative is that our Ontario "Development Club" now looks so good and is so productive that I would hate to do anything that would undermine its success. On the other hand, if we don't support CBS then we cannot really blame anyone else if development doesn't figure in the meetings. So perhaps we should discuss this next time in an informal way - over coffee or lunch. We could get an idea of what everyone else thinks. It may well be that when CBS meets in Ontario we could put on a show, we might organize a whole day on development. And when CBS meets elsewhere then the graduate students couldn't go; but they would still have our meetings as a forum to give papers and as a place to meet other students.

I am glad that you will host the next meeting. I think that the future of our meetings is secure now: three meetings in 1 year and ~ 45 papers, plus posters, is really an achievement and a good indication of the vitality of plant development in Ontario. If I can help in the organization please let me know.

Could you and Carol keep Saturday, November 25th free as a possible day to visit Hamilton. I'll be in touch with you about this again.

With best wishes,

Douglas Davidson,
Professor.

DD/jk